

① test endpoints

② derivative = 0

③ derivative d.n.e.

Extreme Value Theorem
Extrema - maxs & mins

$$y = \frac{1}{x} + \ln x$$

① Endpoints

$$y = \frac{1}{.5} + \ln .5 = 2 + -.7 \approx 1.3$$

$$y = \frac{1}{4} + \ln 4 = .25 + 1.38 \approx 1.63 \quad \text{abs. max}$$

② $y = \frac{1}{x} + \ln x$

$$y' = -x^{-2} + \frac{1}{x} = \frac{-1}{x^2} + \frac{1}{x} \cdot \frac{x}{x}$$

$$y' = \frac{-1 + x}{x^2}$$

$$y' = 0 \rightarrow x = 1$$

$$y' = \text{undefined} \rightarrow \text{when } x = 0$$

$$y = \frac{1}{x} + \ln x$$

$$y = \frac{1}{1} + \ln 1 = 1 + 0 = 1 \quad \text{abs. min.}$$

asymptote $y = \frac{1}{0} + \ln 0$ undefined

13. $y = \ln(x+1)$ $0 \leq x \leq 3$

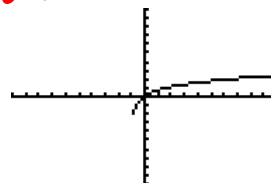
Endpoints

$$y = \ln 1 = 0$$

abs. min

$$y = \ln 4 = 1.38$$

abs. max



$$y = \ln(x+1)$$

$$\frac{dy}{dx} = \frac{1}{x+1}$$

$$\frac{dy}{dx} = 0 \rightarrow \text{never}$$

$$\frac{dy}{dx} = \text{undef. when } x = -1$$

$$y = \ln(x+1) = \ln 0 =$$

$$y = \sin\left(x + \frac{\pi}{4}\right)$$

$$y' = \cos\left(x + \frac{\pi}{4}\right) \cdot 1$$

$$0 \leq x \leq \frac{\pi}{4} \approx 0.785$$

$$\frac{dy}{dx} = 0 \quad \cos\left(x + \frac{\pi}{4}\right) = 0$$

$$\cos \frac{\pi}{2} = 0$$

$$x + \frac{\pi}{4} = \frac{\pi}{2}$$

$$-\frac{\pi}{4} \quad -\frac{\pi}{4}$$

$$x = \frac{\pi}{4}$$

$$\cos \frac{3\pi}{2} = 0$$

$$x + \frac{\pi}{4} = \frac{3\pi}{2}$$

$$-\frac{\pi}{4} \quad -\frac{\pi}{4}$$

$$x = \frac{5\pi}{4}$$

$$\frac{\pi}{2} \quad \frac{3\pi}{2}$$

$$1.5 \cdot 25$$

$$y = \sin\left(x + \frac{\pi}{4}\right)$$

$$x = \frac{\pi}{4}$$

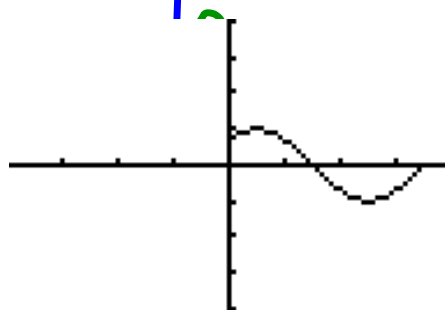
$$y = \sin\left(\frac{\pi}{2}\right) = 1$$

↙ abs. max.

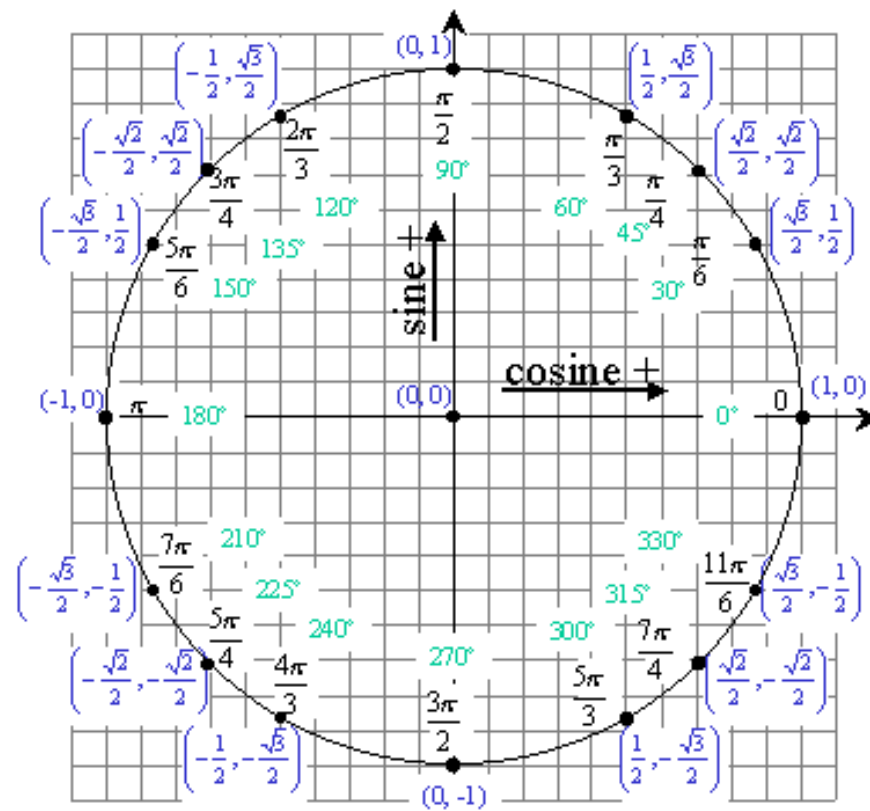
$$y = \sin\left(\frac{3\pi}{2}\right) = -1$$

$$x = \frac{5\pi}{4}$$

min.



$\frac{\pi}{2}$



$3\frac{\pi}{2}$

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